Integrating Natural Enemies, Cultural Control, and Plant Resistance for Sustainable Management of Insect Pests on Golf Courses

University of Kentucky

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Start Date: 1998
Number of Years: 3
Total Funding: $105,000

Objectives:

1. *Evaluate the role of ants as beneficial predators in golf turf: determine the predominant species inhabiting golf courses; and develop tactics for managing mound-building pest ants on putting greens with reduced environmental risk or impact on beneficial species.*
2. *Investigate synergism between endophyte-enhanced, resistant turfgrasses and bio-rational insecticides for improved management of white grubs and black cutworms.*
3. *Examine the main and interacting effects of cultural practices (mowing height, irrigation, and N fertilization) on nutritional and defensive characteristics of creeping bentgrass on relative susceptibility to white grubs and black cutworms.*

Conservation of naturally occurring biological controls is important for reducing need for insecticide usage on golf courses. Ants, the most abundant insects inhabiting turfgrass, are highly efficient predators of eggs and larvae of cutworms, grubs, and other pest insects. On golf courses, however, the positive aspects of ant predation must be weighed against the fact that some species build nests and mounds on putting greens and tees. This research seeks to identify beneficial and harmful ant species, document their significance, and develop effective means for controlling pest ants while conserving useful, predatory species.

Surveys of ants inhabiting roughs, fairways, tees, and putting greens of central Kentucky golf courses revealed that virtually all of the mound-building problems in close-cut creeping bentgrass are caused by one species, *Lasius neoniger*. *Lasius* appears to be the major nuisance ant on golf courses throughout much of the United States. Surface insecticides usually won't eliminate these ants because they fail to reach the ground nesting queen.

We evaluated two novel approaches for suppressing mounding activity on tees and greens. The first involved use of target-selective ant baits, some of which already have revolutionized ant control tactics used by the structural pest control industry. After testing seven candidate baits for acceptability to *Lasius*, we selected the three most attractive ones for evaluation on golf courses. These baits contained as active ingredients either avermectin (Advance Granular Carpenter Ant Bait; WhitMire Micro-Gen, Inc.) hydramethylnon (Maxforce granular ant bait; Clorox, Inc.), or spinosad (NAF-464; Dow AgroSciences). Each has a different, insect-specific mode of action, low mammalian toxicity, and favorable environmental characteristics. Advance and MaxForce already are labeled for use on turfgrass sites. Field trials on golf tees showed that use of these baits will provide rapid, 80 to 95 percent elimination of *Lasius* mounds and nests, either by broadcast, or by selective application from a shaker can. In another study, fipronil (Chipco Choice, Rhone-Poulenc, Inc.) was found effective for season-long suppression of *Lasius* nests and mounds on putting greens. This novel phenyl pyrazole, characterized by low mammalian toxicity and very low use rates, is a promising candidate for ant management on golf courses.

Field experiments demonstrated that *Lasius neoniger* and other ant species are very important in suppressing other insect pests. In trial after trial on roughs, fairways, or putting greens, ants eliminated large numbers of eggs and young larvae of black cutworms, and eggs of Japanese beetle. This underscores the wisdom of selective, rather than fence-to-fence, management of nuisance ants where mound building becomes a problem. Fortunately, our related work with halofenozide (Mach 2) and imidacloprid (Merit) has shown that these powerful new insecticides are compatible with preservation of beneficial species, including ants.

Our second objective concerns whether use of insect-resistant grasses in combination with reduced-risk insecticides can provide levels of control previously possible only with more broad-spectrum pesticides. In 1998, we studied possible synergistic or antagonistic interactions between endophytic perennial ryegrass and efficacy of *Bacillus thuringiensis* (Bt), *Bacillus popilliae* (milky disease bacteria), and spinosad (Conserve). We sought to determine if the sublethal stress endured by pests feeding on endophytic grass might enhance the activity of these products. Dose-mortality studies with Bt and spinosad were conducted with black cutworms fed on either endophytic (E +) or non-endophytic (E-) grass. Even full label rates of Bt provided no suppression of cutworms, irrespective of endophyte level. Spinosad provided 100 percent control, even at 1/4 label rate, on both E+ and E- grass. Dose-mortality studies with milky disease and Japanese beetle grubs showed significant rate effects, but disease incidence was not affected by endophyte level.

Finally, progress continued toward identifying the female sex pheromone of northern and southern masked chafers, the most destructive native grubs species in the United States. A synthetic bait would be useful for monitoring, fine-tuning treatment schedules, or assessing local grub densities on golf courses. Earlier, we discovered that the pheromone also is present in the grubs. In 1998, approximately 10,000 grubs were dug from Kentucky golf courses for pheromone collection. The grubs were rinsed in hexane to remove the pheromone; extracts were sent to collaborators (A. Attygalle, J. Meinwald, Cornell University) for analysis. The chemical peak representing the

pheromone was pinpointed by gas chromatography and electroantennogram analysis, and its molecular weight was determined. Gas phase IR was used to further characterize the compound's structure. Hopefully, the identification can be completed this winter, so that field testing during beetle flights can begin in 1999.

A Parasitic Fly that Kills Mole Crickets: Its Use in States North of Florida.

University of Florida

Dr. J. Howard Frank

Start Date: 1998
Number of Years: 3
Total Funding: $26,680

Objectives:

1. *To explore farther south in South America (colder climates) to obtain stocks of the fly Ormia depleta, a natural enemy of the mole cricket.*
2. *To culture the captured South American flies in our laboratory and supply them to collaborators in other states for release.*

Ormia depleta is a tachinid fly specialist on some species of *Scapteriscus* mole crickets. It is native to Brazil and Paraguay. A stock of this fly, captured at Piricicaba in subtropical Brazil (about 23° S) was brought to Florida in 1987 and cultured in quarantine. Beginning in 1988, progeny of these flies were released in all areas of Florida in an attempt to establish a population - about 10,000 flies were released. A population became established in peninsular Florida and persists year-round to about 28°N latitude, and seasonally (the fall of each year) in a marginal area extending to about 29°N. Subsequent releases in Georgia, North Carolina, and Alabama did not result in establishment of populations there.

Although the established populations of the fly exhibit strong seasonality in Florida, with much greater numbers trapped in May-June and in November-December than at other times of year, the fly seems capable of breeding throughout the year. That is, there is no dormant period (diapause) in winter. In the laboratory, adult flies need artificial nectar as a dietary item. Thus, it seems that the established stock of the fly, from subtropical Brazil, fares poorly in winter in northern Florida perhaps because it is not adapted to diapause during those months of the winter when plant nectars are in short supply (after freezes).

The fly is known to exist in southern Brazil to 30°S. It is possible that flies at 30°S are adapted to withstand colder winters by entering diapause. Therefore, they might be expected to survive in the southern USA at 30°N, and perhaps much farther north. The objective of this project is to obtain a stock of the fly from extreme southern Brazil, bring it to quarantine in Gainesville, culture it, and provide stock to collaborating turfgrass entomologists in Alabama, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, and Texas.

In November 1998, two entomologists will travel to southern Brazil to spend almost four weeks collecting living *Scapteriscus* mole crickets as hosts for the fly. When scores of mole crickets have been assembled and maintained in containers in a laboratory in southern Brazil, flies will be trapped. Larvae of the flies will be reared on the mole crickets, and brought to the pupal stage. Fly pupae will be brought to quarantine in Florida for establishment of a laboratory culture. The timing of the visit (early summer) is based upon what is known about abundance and seasonality of *Scapteriscus* mole crickets and the fly in subtropical and temperate Brazil.

Work in 1999 will focus on labor-intensive culturing of several of the fly for distribution to other southern states.

Best Management Practices for New Dwarf Bermudagrasses

Texas A&M University

Richard H. White

Start Date: 1998
Number of Years: 3
Total Funding: $69,989

Objectives:

1. *Determine the performance, mowing tolerance, and pest resistance of 15 experimental and commercially available bermudagrass and one zoysiagrass on a golf green.*
2. *Determine the effects of vertical mowing, topdressing, and nitrogen fertility on performance, thatch development, fall and spring overseeding trasition, and turf quality of five dwarf bermudagrasses.*

New dwarf bermudagrasses are, in general, more aggressive thatch producers than *TIFDWARF*. Judicious nitrogen fertilization will be required to slow the rate of thatch accumulation for many of the new bermudagrass cultivars. Nitrogen amounts greater than 10 pounds annually per 1000 square feet improved turf quality but contributed to increased thatch, decreased ball roll distance, and did not substantially increase shoot density. No differences in thatch accumulation have been observed among light (frequent) and severe (infrequent) vertical mowing and topdressing regimes. However, severe, infrequent vertical mowing reduced turf quality for long periods. Overseeded *Poa trivialis* establishment the first season was good for all grasses when light, frequent vertical mowing was applied during the growing season.

Several new-dwarf bermudagrasses provided good to excellent turf quality and were superior to *TIFDWARF* at 0. 125 inch mowing heights. Mean turf quality of *MINIVERDE, TIFEAGLE, CHAMPION, MOBILE, FLORADWARF, MS SUPREME,*